

MICROMORPHOLOGICAL STUDIES OF *CAREX* SECTION  
*MITRATAE* (CYPERACEAE) IN TURKEY

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ABSTRACT. Scanning electron microscopy was used to examine achene epidermal features in species of *Carex* section *Mitratae* and the allied section *Acrocystis* found in Turkey. Members of section *Mitratae* share a particular achene phenotype. Micromorphological characters appear to be conservative, and show little variation between species of section *Mitratae*. Comparative data of achene micromorphology support the placement of *C. tomentosa* within section *Acrocystis*.

Key Words: *Carex*, *Mitratae*, Cyperaceae, systematics, achene, SEM

*Carex* section *Mitratae* Kük. has comprised three taxa in Turkey: *C. umbrosa* subsp. *huetiana*, *C. caryophyllea*, and *C. depressa* subsp. *transsilvanica*. One species was recognized within section *Acrocystis* Dumort. [= *Montanae* (Fries) Carey]: *C. tomentosa* (Nilsson 1985). These sections (*Mitratae* and *Acrocystis*) have been combined into one unit, as section *Onkerma* (Rafin) Krecz. (Kreczetovicz 1935). Chater (1980) and Nilsson (1985) outlined several morphological features that distinguish the species of section *Mitratae*. Members of *Carex* section *Mitratae* are distinguished from taxa in other sections of *Carex* by achenes with annular, whitish apical discs.

Achene epidermis characters have been used in many studies on *Carex* taxonomy at both the specific and the sectional levels (Crins and Ball 1988; Menapace and Wujek 1985, 1987; Menapace et al. 1986; Rettig 1986, 1990; Salo et al. 1994; Standley 1985, 1987a, b, 1990; Tallent and Wujek 1983; Toivonen and Timonen 1976; Waterway 1990; Wujek and Menapace 1986). Usually these characters have provided criteria useful for delimitation of taxa at various levels. They have also been used for distinguishing species within critical groups (Rettig 1990; Standley 1987a, b). However, studies on taxa within the *C. crinita* complex (Bruederle et al. 1989) and the *C. flava* complex (Salo et al. 1994) indicated that achene micromorphology was not useful in distinguishing taxa because of the considerable amount of

Table 1. Collection data for *Carex* species used for SEM observations.Section *Mitratae**C. umbrosa* Host. subsp. *huetiana* Boiss.RÍZE: Kaçkar, *Olgun* 58; Cimil, *Olgun* 63; TRABZON: Solma y.,  
*Olgun* 83; Çakılgöl, *Olgun* 85.*C. caryophyllea* Latourr.RÍZE: Balliköy, *Olgun* 15; Ovit, *Olgun* 57; Cimil, *Olgun* 64.*C. depressa* Link. subsp. *transsilvanica* Schur.TRABZON: Sümela, *Olgun* 2; KTÜ Kampüs, *Olgun* 11; RÍZE:  
Balliköy, *Olgun* 16; Cimil, *Olgun* 74.Section *Acrocystis**C. tomentosa* L.TRABZON: Zingana, *Olgun* 9; Kiremithaneler, *Olgun* 13; Erikbeli,  
*Olgun* 76.

variation within species. Studies on the sections *Heleonastes* (Toivonen and Timonen 1976), *Folliculatae* (Wujek and Menapace 1986) and *Lupulinae* (Menapace et al. 1986) illustrated that achene micromorphology may differ more drastically from one section to another than from species to species. In other studies, variation within well-defined sections was found to be as great as variation between sections (Menapace and Wujek 1985; Rettig 1986; Waterway 1990). Salo et al. (1994) indicated that the utility of achene epidermis characters as a basis of taxonomic decisions varies greatly in the different sections of *Carex*.

In the present work, achene micromorphology of section *Mitratae* was examined by SEM and *Carex tomentosa* (from the related section *Acrocystis*) was used for comparison.

## MATERIALS AND METHODS

Perigynia containing mature achenes of all species of *Carex* sections *Mitratae* and *Acrocystis* were taken from herbarium specimens deposited at the Karadeniz Technical University Herbarium (KTUB). Three or four accessions of each species were examined. Observations were made on six to eight achenes from each accession. Collection data for SEM studies are given in Table 1.

Achenes were treated with a 1 : 9 (v/v) mixture of concentrated sulfuric acid: acetic anhydride and sonicated in ultrasonic cleaner for 1 to 2 hours to remove the outer cell walls (Tallent and Wujek 1983; Toivonen and Timonen 1976). Dried achenes were sputter

coated with 200–300 Å of gold before observation with a JSM-6400 SEM. Upper shoulders of achenes were photographed at an accelerating voltage of 5 kV. Micrographs were usually obtained at magnifications of 1500×. Terminology used in describing the anticlinal walls and the silica deposits follows Rettig (1990).

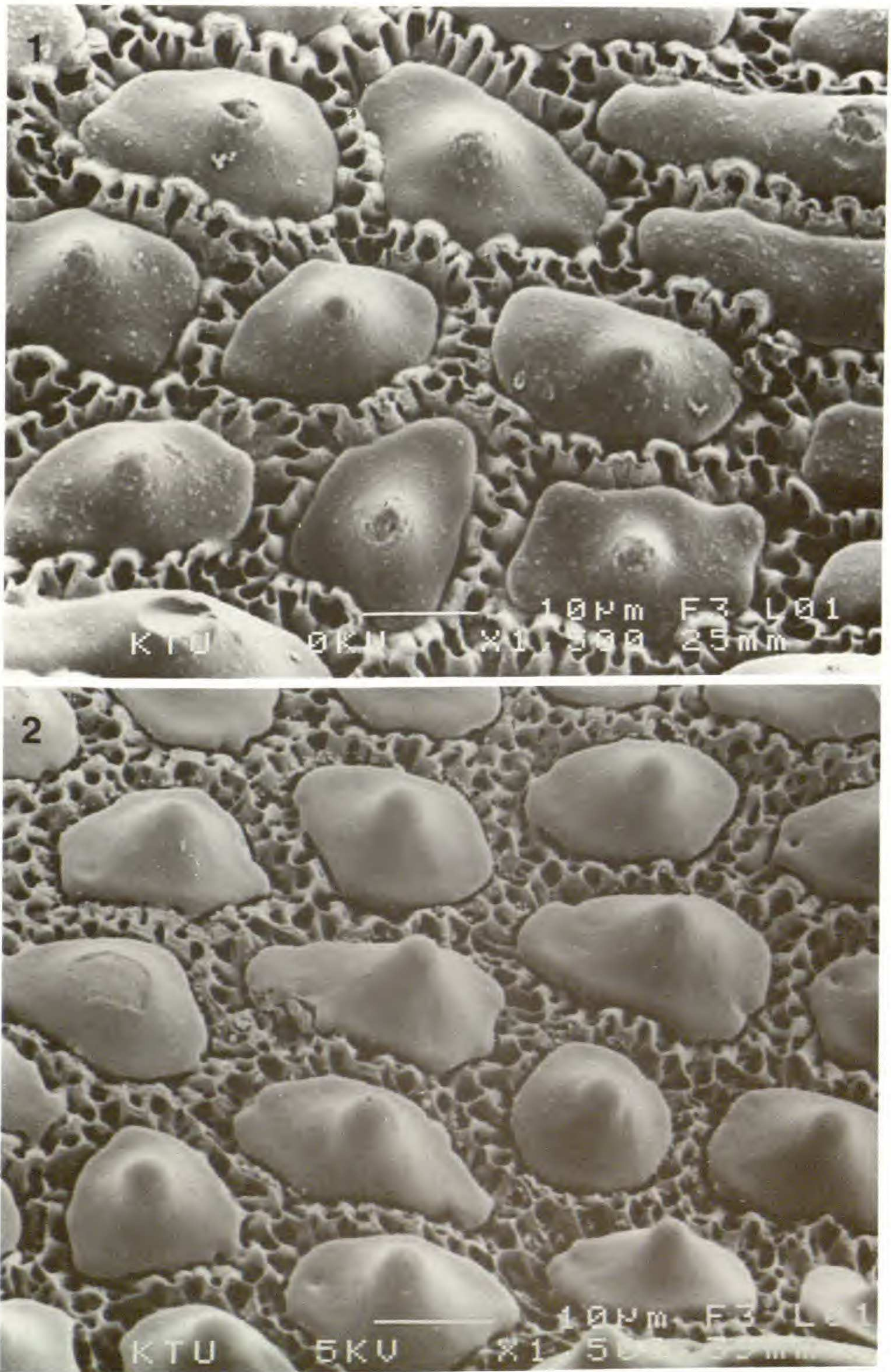
#### RESULTS AND DISCUSSION

Representative scanning electron micrographs of four taxa are shown in Figures 1 through 6. As can be seen from the figures, the species of section *Mitratae* share a particular achene micromorphology. *Carex umbrosa* subsp. *huetiana*, *C. caryophyllea*, and *C. depressa* subsp. *transsilvanica* have convex silicon platforms with round corners and honeycombed anticlinal walls. These characters were constant for all cells of achenes of these species.

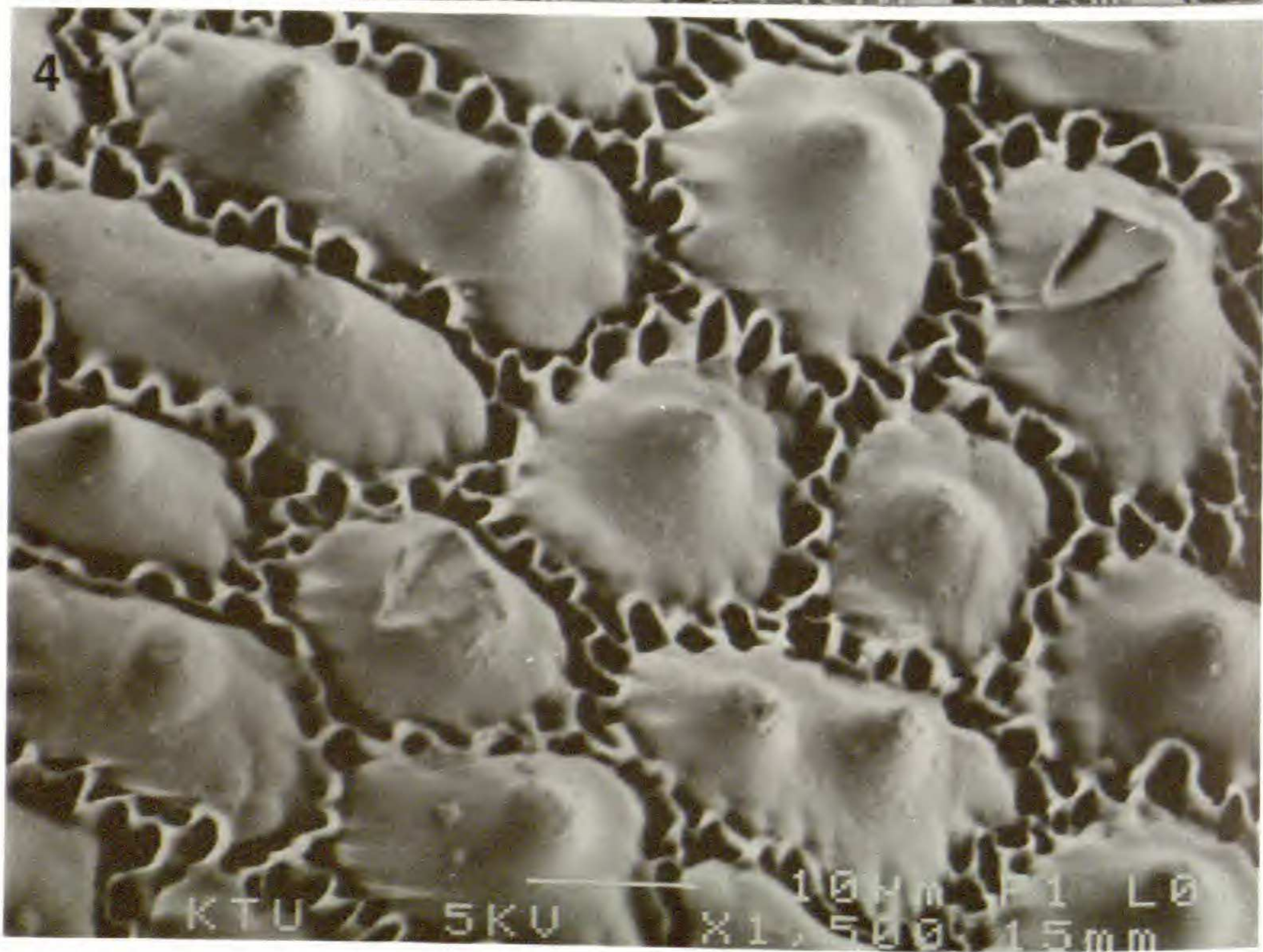
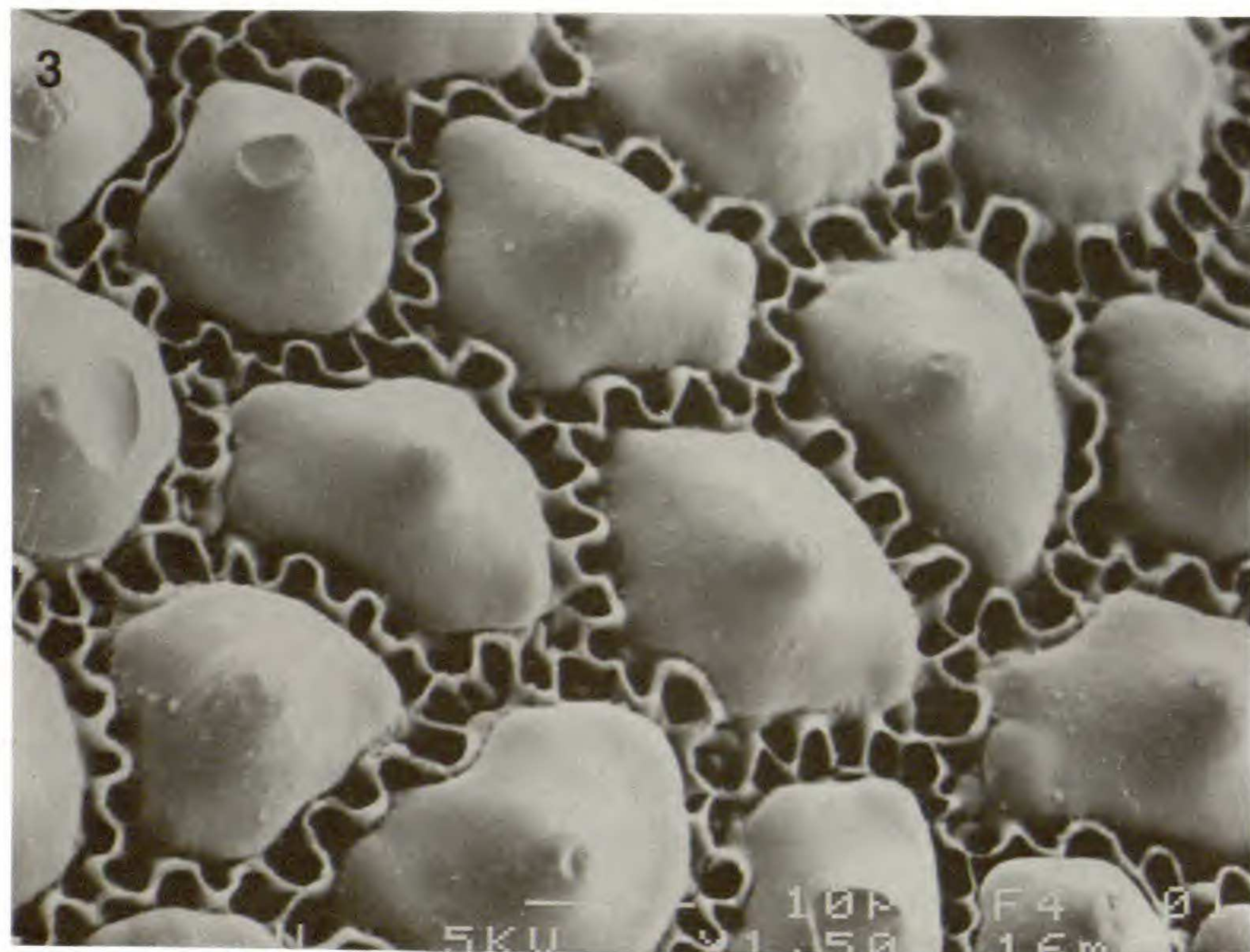
*Carex caryophyllea* (Figure 1) and *C. depressa* subsp. *transsilvanica* (Figure 2) are different from *C. umbrosa* subsp. *huetiana* based on the presence of a silicon body. The achene cells of *C. caryophyllea* and *C. depressa* subsp. *transsilvanica* always have one silicon body, while the cells of *C. umbrosa* typically have one (Figure 3), rarely two (Figure 4), or sometimes no silicon body (Figure 5).

The achene micromorphology of *Carex tomentosa* (Figure 6) is in contrast to species of section *Mitratae* by having thin, straight anticlinal walls. Furthermore, the silicon platforms are concave with sharp corners.

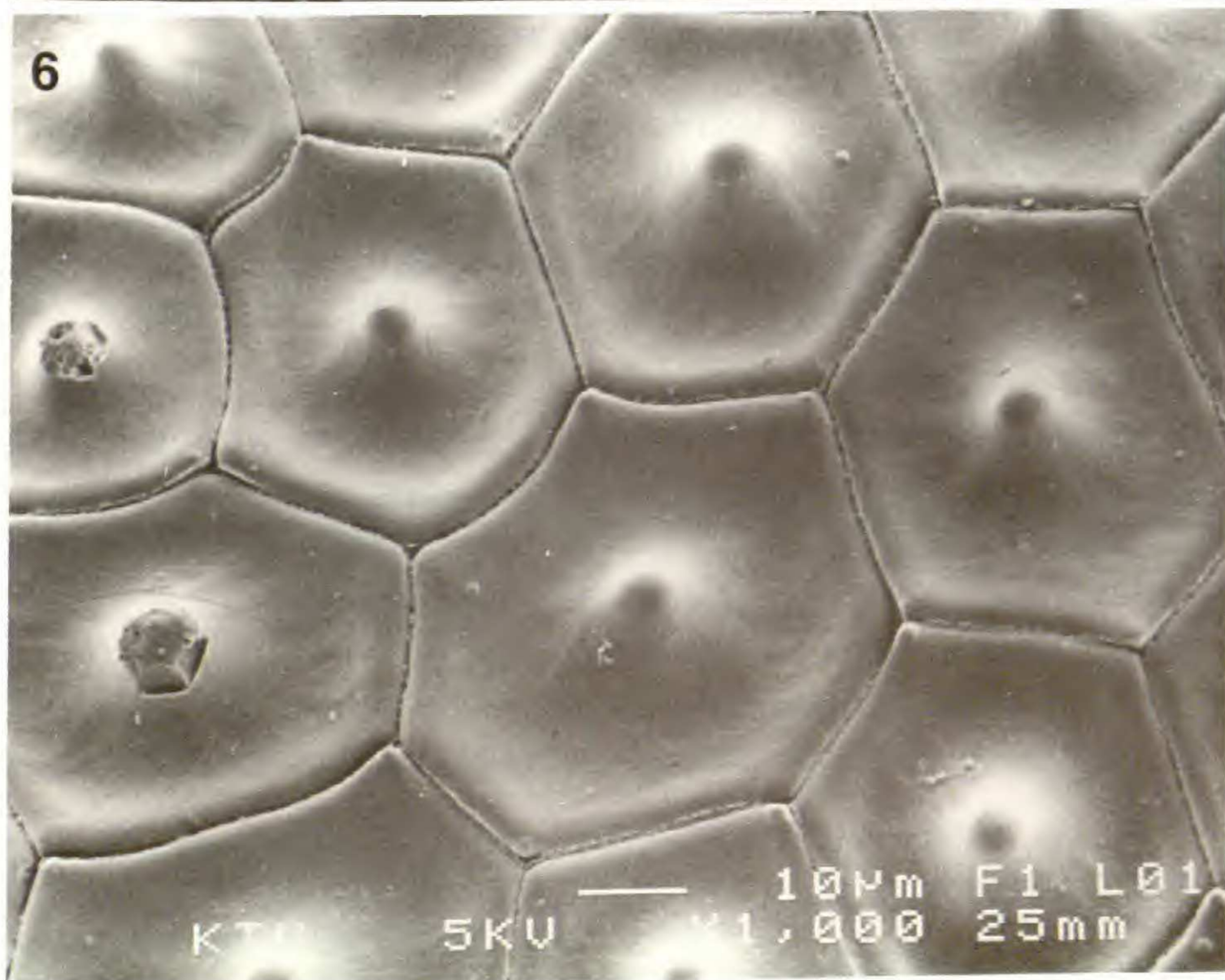
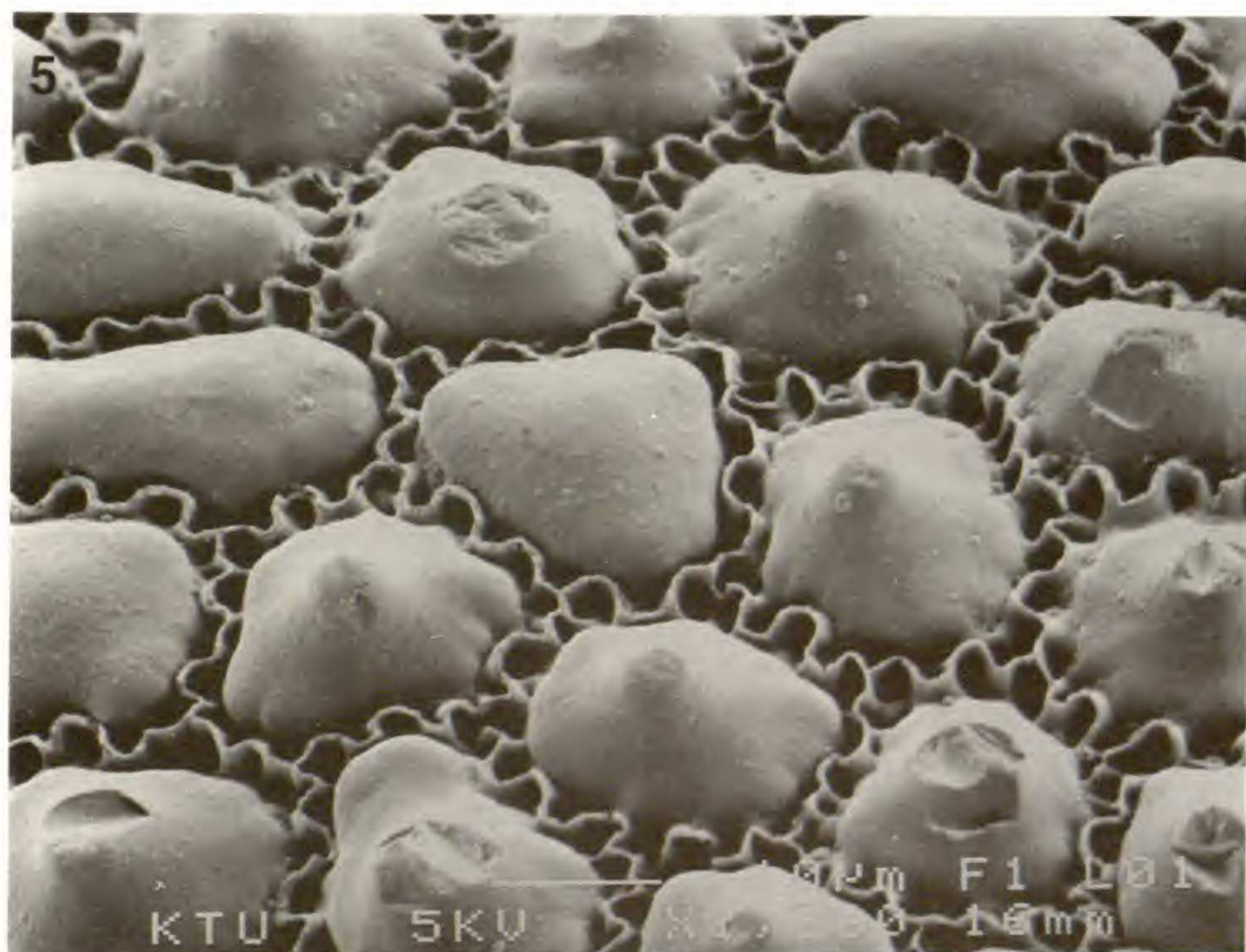
In this study, no significant variation in micromorphological characters within species was observed and variation also was minimal within section *Mitratae*. Achene micromorphology of section *Mitratae* is characterized by special anticlinal walls, and these characters may provide useful data to delineate the section rather than to distinguish species. Epidermal features of *Carex tomentosa* are significantly different from the taxa of section *Mitratae*. These examples illustrate the correspondence between achene epidermal features and sectional classifications of the species examined. Our observations are concordant with classifications of these species at the sectional level (Chater 1980; Nilsson 1985). However, the honeycomb anticlinal wall structure has been reported on the achene cells of *C. emmonsii* Dewey ex Torrey var. *muhlenbergii* (A. Gray) J. Rettig from section *Acrocystis*



Figures 1–2. SEM photographs of *Carex* achenes. 1. (top) *C. caryophyllaea* 2. (bottom) *C. depressa* subsp. *transsilvanica*. Scale bar = 10 μm.



Figures 3–4. SEM photographs of *Carex umbrosa* subsp. *huetiana* achenes. Scale bar = 10  $\mu$ m.



Figures 5–6. SEM photographs of *Carex* achenes. 5. (top) *C. umbrosa* subsp. *huetiana* 6. (bottom) *C. tomentosa*. Scale bar = 10 µm.

(Rettig 1990). This similarity supports the hypothesis that there is a close relationship between the species of these two sections.

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